Complete Summary

GUIDELINE TITLE

Guideline on use of nitrous oxide for pediatric dental patients.

BIBLIOGRAPHIC SOURCE(S)

American Academy of Pediatric Dentistry (AAPD). Guideline on use of nitrous oxide for pediatric dental patients. Chicago (IL): American Academy of Pediatric Dentistry (AAPD); 2009. 4 p. [21 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: American Academy of Pediatric Dentistry (AAPD). Clinical guideline on appropriate use of nitrous oxide for pediatric dental patients. Chicago (IL): American Academy of Pediatric Dentistry (AAPD); 2005. 4 p. [16 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Pain and anxiety associated with dental procedures

GUIDELINE CATEGORY

Management
Treatment

CLINICAL SPECIALTY

Anesthesiology
Dentistry
Pediatrics

INTENDED USERS

Dentists

GUIDELINE OBJECTIVE(S)

To assist the dental profession in developing appropriate practices in the use of nitrous oxide/oxygen analgesia/anxiolysis for pediatric patients

TARGET POPULATION

Infants, children, adolescents, and individuals with special health care needs undergoing dental procedures

INTERVENTIONS AND PRACTICES CONSIDERED

Clinical Assessment

1. Patient selection
2. Review of medical history
3. Specialist consultation

Management

1. Technique of nitrous oxide/oxygen administration
2. Patient monitoring during procedure (patient's responsiveness, color, respiratory rate and rhythm, spoken responses)
3. Documentation
    - Informed consent
    - Provision of instructions to the parent (regarding pre-treatment dietary precautions)
    - Recording of indication, dose, flow, procedure duration, post treatment oxygenation procedure

Facilities/Personnel/Equipment

1. Proper gas delivery and fail-safe function
2. Appropriate oxygen concentration
3. Training and certification in basic life supportÂ for all clinical personnel
4. Periodic review of safety procedures (the office's emergency protocol, the emergency drug cart, and simulated exercises to assure proper emergency management response)

MAJOR OUTCOMES CONSIDERED

- Control of pain and anxiety
- Side effects of nitrous oxide

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

This guideline is based on a review of the current dental and medical literature related to nitrous oxide/oxygen analgesia/anxiolysis in pediatric patients. A MEDLINE search was conducted using the terms "nitrous oxide", "analgesia", "anxiolysis", "behavior management", and "dental treatment."

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus (Committee)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The oral health policies and clinical guidelines of the American Academy of Pediatric Dentistry (AAPD) are developed under the direction of the Board of Trustees, utilizing the resources and expertise of its membership operating through the Council on Clinical Affairs (CCA).

Proposals to develop or modify policies and guidelines may originate from 4 sources:

1. The officers or trustees acting at any meeting of the Board of Trustees
2. A council, committee, or task force in its report to the Board of Trustees
3. Any member of the AAPD acting through the Reference Committee hearing of the General Assembly at the Annual Session
4. Officers, trustees, council and committee chairs, or other participants at the AAPD's Annual Strategic Planning Session

Regardless of the source, proposals are considered carefully, and those deemed sufficiently meritorious by a majority vote of the Board of Trustees are referred to the CCA for development or review/revision.

Once a charge (directive from the Board of Trustees) for development or review/revision of an oral health policy or clinical guideline is sent to the CCA, it is assigned to 1 or more members of the CCA for completion. CCA members are instructed to follow the specified format for a policy or guideline. All oral health policies and clinical guidelines are based on 2 sources of evidence: (1) the scientific literature; and (2) experts in the field. Members may call upon any expert as a consultant to the council to provide expert opinion. The Council on Scientific Affairs provides input as to the scientific validity of a policy or guideline.

The CCA meets on an interim basis (midwinter) to discuss proposed oral health policies and clinical guidelines. Each new or reviewed/revised policy and guideline is reviewed, discussed, and confirmed by the entire council.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Once developed by the Council on Clinical Affairs (CCA), the proposed policy or guideline is submitted for the consideration of the Board of Trustees. While the board may request revision, in which case it is returned to the council for modification, once accepted by majority vote of the board, it is referred for Reference Committee hearing at the upcoming Annual Session. At the Reference Committee hearing, the membership may provide comment or suggestion for alteration of the document before presentation to the General Assembly. The final document then is presented for ratification by a majority vote of the membership present and voting at the General Assembly. If accepted by the General Assembly, either as proposed or as amended by that body, the document then becomes the official American Academy of Pediatric Dentistry (AAPD) oral health

policy or clinical guideline for publication in the AAPD's Reference Manual and on the AAPD's Web site.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Patient Selection

Indications for use of nitrous oxide/oxygen analgesia/anxiolysis include:

- A fearful, anxious, or obstreperous patient
- Certain patients with special health care needs
- A patient whose gag reflex interferes with dental care
- A patient for whom profound local anesthesia cannot be obtained
- A cooperative child undergoing a lengthy dental procedure

Review of the patient's medical history should be performed prior to the decision to use nitrous oxide/oxygen analgesia/anxiolysis. This assessment should include:

- Allergies and previous allergic or adverse drug reactions
- Current medications including dose, time, route, and site of administration
- Diseases, disorders, or physical abnormalities and pregnancy status
- Previous hospitalization to include the date and purpose

Contraindications for use of nitrous oxide/oxygen inhalation may include:

- Some chronic obstructive pulmonary diseases
- Severe emotional disturbances or drug-related dependencies
- First trimester of pregnancy
- Treatment with bleomycin sulfate
- Methylenetetrahydrofolate reductase deficiency

Whenever possible, appropriate medical specialists should be consulted before administering analgesic/anxiolytic agents to patients with significant underlying medical conditions (e.g., severe obstructive pulmonary disease, congestive heart failure, sickle cell disease, acute otitis media,Â recent tympanic membrane graft, acute severe head injury).

Technique of Nitrous Oxide/Oxygen Administration

Nitrous oxide/oxygen must be administered only by appropriately licensed individuals, or under the direct supervision thereof, according to state law. The practitioner responsible for the treatment of the patient and/or the administration of analgesic/anxiolytic agents must be trained in the use of such agents and techniques and appropriate emergency response.

Selection of an appropriately-sized nasal hood should be made. A flow rate of 5 to 6 liters/minute generally is acceptable to most patients. The flow rate can be adjusted after observation of the reservoir bag. The bag should pulsate gently

with each breath and should not be either over- or underinflated. Introduction of 100% oxygen for 1 to 2 minutes followed by titration of nitrous oxide in 10% intervals is recommended. During nitrous oxide/oxygen analgesia/anxiolysis, the concentration of nitrous oxide should not routinely exceed 50%. Nitrous oxide concentration may be decreased during easier procedures (e.g., restorations) and increased during more stimulating ones (e.g., extraction, injection of local anesthetic). During treatment, it is important to continue the visual monitoring of the patient's respiratory rate and level of consciousness. The effects of nitrous oxide largely are dependent on psychological reassurance. Therefore, it is important to continue traditional behavior guidance techniques during treatment. Once the nitrous oxide flow is terminated, 100% oxygen should be delivered for 3 to 5 minutes. The patient must return to pre-treatment responsiveness before discharge.

Monitoring

The response of patients to commands during procedures performed with anxiolysis/analgesia serves as a guide to their level of consciousness. Clinical observation of the patient must be done during any dental procedure. During nitrous oxide/oxygen analgesia/anxiolysis, continual clinical observation of the patient's responsiveness, color, and respiratory rate and rhythm must be performed. Spoken responses provide an indication that the patient is breathing. If any other pharmacologic agent is used in addition to nitrous oxide/oxygen and a local anesthetic, monitoring guidelines for the appropriate level of sedation must be followed.

Adverse Effects of Nitrous Oxide/Oxygen Inhalation

Nitrous oxide/oxygen analgesia/anxiolysis has an excellent safety record. When administered by trained personnel on carefully selected patients with appropriate equipment and technique, nitrous oxide is a safe and effective agent for providing pharmacological guidance of behavior in children. Acute and chronic adverse effects of nitrous oxide on the patient are rare. Nausea and vomiting are the most common adverse effects, occurring inÂ 0.5% of patients. A higher incidence is noted with longer administration of nitrous oxide/oxygen, fluctuations in nitrous oxide levels, and increased concentrations of nitrous oxide. Fasting is not required for patients undergoing nitrous oxide analgesia/anxiolysis.Â The practitioner, however,Â may recommend that only a light meal be consumed in the 2 hours prior to the administration of nitrous oxide. Diffusion hypoxia can occur as a result of rapid release of nitrous oxide from the blood stream into the alveoli, thereby diluting the concentration of oxygen. This may lead to headache and disorientation and can be avoided by administering 100% oxygen after nitrous oxide has been discontinued.

Documentation

Informed consent must be obtained from the parent and documented in the patient's record prior to administration of nitrous oxide/oxygen. The practitioner should provide instructions to the parent regarding pre-treatment dietary precautions, if indicated. In addition, the patient's recordÂ should include indication for use of nitrous oxide/oxygen inhalation, nitrous oxide dosage (i.e.,

percent nitrous oxide/oxygen and/or flow rate), duration of the procedure, and post-treatment oxygenation procedure.

Facilities/Personnel/Equipment

All newly installed facilities for delivering nitrous oxide/oxygen must be checked for proper gas delivery and fail-safe function prior to use. Inhalation equipment must have the capacity for delivering 100%, and never less than 30%, oxygen concentration at a flow rate appropriate to the child's size.Â Additionally, inhalation equipmentÂ must have a fail-safe system that is checked and calibrated regularly according to the practitioner's state laws and regulations. If nitrous oxide/oxygen delivery equipment capable of delivering more than 70% nitrous oxide and less than 30% oxygen is used, an in-line oxygen analyzer must be used. The equipment must have an appropriate scavenging system.

The practitioner who utilizes nitrous oxide/oxygen analgesia/anxiolysis for a pediatric dental patient shall possess appropriate training and skills and have available the proper facilities, personnel, and equipment to manage any reasonably foreseeable emergency. Training and certification in basic life supportÂ are required for all clinical personnel. These individuals should participate in periodic review of the office's emergency protocol, the emergency drug cart, and simulated exercises to assure proper emergency management response.

An emergency cart (kit) must be readily accessible. Emergency equipment must be able to accommodate children of all ages and sizes. It should include equipment to resuscitate a non-breathing, unconscious patient and provide continuous support until trained emergency personnel arrive. A positive pressure oxygen delivery system capable of administering >90% oxygen at a 10 liters/minute flow for at least 60 minutes (650 liters, "E" cylinder) must be available. When a self-inflating bag valve mask device is used for delivering positive pressure oxygen, a 15 liters/minute flow is recommended. There should be documentation that all emergency equipment and drugs are checked and maintained on a regularly scheduled basis. Where state law mandates equipment and facilities, such statutes should supersede this guideline.

Occupational Safety

In an effort to reduce occupational health hazards associated with nitrous oxide, the American Academy of Pediatric Dentistry (AAPD) recommends exposure to ambient nitrous oxide be minimized through use of effective scavenging systems and periodic evaluation and maintenance of the delivery and scavenging systems.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

All oral health policies and clinical guidelines are based on 2 sources of evidence: (1) the scientific literature; and (2) experts in the field.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Reduced or elimination of anxiety
- Reduced untoward movement and reaction to dental treatment
- Enhanced communication and patient cooperation
- Raising of the pain reaction threshold
- Increased tolerance for longer appointments
- Aided treatment of the mentally/physically disabled or medically compromised patient
- Reduced gagging
- Potentiated effect of other sedatives

POTENTIAL HARMS

- For some patients the feeling of "losing control" with nitrous oxide may be troubling, and claustrophobic patients may find the nasal hood confining and unpleasant.
- Side effects of nitrous oxide include nausea, vomiting, headache, and disorientation.
- Although rare, silent regurgitation and subsequent aspiration need to be considered with nitrous oxide/oxygen sedation. The concern lies in whether pharyngeal-laryngeal reflexes remain intact.
- Interference of the nasal hood with injection to anterior maxillary region
- Nitrous oxide pollution and potential occupational exposure health hazards can occur.

CONTRAINDICATIONS

CONTRAINDICATIONS

Contraindications for use of nitrous oxide/oxygen inhalation may include:

- Some chronic obstructive pulmonary diseases
- Severe emotional disturbances or drug-related dependencies
- First trimester of pregnancy
- Treatment with bleomycin sulfate
- Methylenetetrahydrofolate reductase deficiency

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Chart Documentation/Checklists/Forms
Resources

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Staying Healthy

IOM DOMAIN

Effectiveness
Safety

IDENTIFYING INFORMATION AND AVAILABILITY

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ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2005 (revised 2009)

GUIDELINE DEVELOPER(S)

American Academy of Pediatric Dentistry - Professional Association

SOURCE(S) OF FUNDING

American Academy of Pediatric Dentistry

GUIDELINE COMMITTEE

Council on Clinical Affairs

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

The Council on Clinical Affairs (CCA) is comprised of individuals representing the six geographical (trustee) districts of the American Academy of Pediatric Dentistry (AAPD), along with additional consultants confirmed by the Board of Trustees. CCA collaborates with the AAPD Council on Scientific Affairs.

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Council members and consultants derive no financial compensation from the American Academy of Pediatric Dentistry (AAPD) for their participation and are asked to disclose potential conflicts of interest. No conflicts were identified.

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GUIDELINE AVAILABILITY

Electronic copies: Available from the American Academy of Pediatric Dentistry Web site.

Print copies: Available from the American Academy of Pediatric Dentistry, 211 East Chicago Avenue, Suite 700, Chicago, Illinois 60611

AVAILABILITY OF COMPANION DOCUMENTS

Information about the American Academy of Pediatric Dentistry (AAPD) mission and guideline development process is available on the AAPD Web site.

The following implementation tools are available for download from the AAPD Web site:

- Dental growth and development chart
- American Academy of Pediatric Dentistry Caries-Risk Assessment Tool (CAT)

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI on August 19, 2005. This NGC summary wasÂ updated by ECRI Institute on February 22, 2010. The updated information was verified by the guideline developer on March 22, 2010.

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